UNIVERSIDAD COMPLUTENSE MADRID

Proyecto de Innovación

Convocatoria 2018/2019

Nº de proyecto: 154

# Mejora de las habilidades comunicativas y el pensamiento crítico en estudiantes de Ciencias de la Salud mediante la combinación de *flipped classroom* (clase invertida) y debate formal

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## 1. Objetivos propuestos en la presentación del proyecto

El presente Proyecto de Innovación se ha encuadrado dentro de la línea de actuación "Nuevas metodologías e innovación en enseñanza presencial y enseñanza semipresencial".

En los últimos años, las Facultades de Ciencias de la Salud se enfrentan al desafío de transformar radicalmente la educación biomédica, con el fin de preparar mejor a los graduados para la práctica básico-clínica en un entorno tan dinámico como es el de la atención de la salud (Hannafin y Phillips, J Healthcare Commun, 2;4:44, 2017). Para lograr esto, el profesorado necesita desarrollar estrategias efectivas para facilitar el aprendizaje e involucrar a los estudiantes en formas activas y autodirigidas de enseñanza. La literatura indica que el uso de la clase magistral ya no es un método plenamente efectivo para el alumnado que se está incorporando actualmente a la Universidad (Roehl y cols., J Fam Consum Sci 105:44-49, 2013). En este contexto, la *flipped classroom* o clase invertida se ha descrito como una estrategia adecuada para lograr los objetivos de aprendizaje en esta cohorte. Así, cada vez hay más pruebas de que el modelo de aprendizaje basado en la clase invertida tiene componentes que pueden ser atractivos tanto para el profesorado como para los estudiantes y que ayudan a estos últimos a alcanzar objetivos importantes, como permitirles convertirse en pensadores críticos y, al mismo tiempo, estimular el desarrollo de una comprensión profunda del material de estudio. En el aula tradicional, el conocimiento fundamental se transfiere pasivamente a los estudiantes durante la clase a través de una conferencia o clase magistral impartida por el profesorado. Después de la conferencia, los estudiantes usan y aplican este conocimiento fuera del aula (Chen y cols., Med Educ 51:585-597, 2017). En general, la clase invertida representa un enfoque en el cual las tareas que se completan dentro y fuera del aula son opuestas a las que ocurren en un aula tradicional, en el sentido de que el alumnado adquiere los conocimientos fundamentales a través del aprendizaje a su propio ritmo y antes de la clase. La aplicación del conocimiento aprendido y la resolución de problemas se producen dentro del aula a través del profesorado, que favorece las actividades centradas en el alumnado (Jensen y cols., CBE-Life Sci Educ, 14:1-12, 2015). Particularmente, en el aula invertida el alumnado es expuesto al material fuera del aula, mediante la lectura de textos seleccionados por el profesorado o el visionado de vídeos, y el tiempo de clase se utiliza para reforzar, validar, aplicar, analizar y sintetizar la información (https://cft.vanderbilt.edu//cft/guides-sub-pages/flipping-the-classroom/). Sin embargo, si bien existe literatura que propone esta metodología como modelo de éxito en diversas asignaturas de otras áreas de conocimiento, en el caso de las Ciencias de la Salud, las publicaciones que describen el uso de la clase invertida no son abundantes.

La carencia en habilidades de comunicación y gestión emocional en las profesiones sanitarias es una realidad constatada. De hecho, los profesionales de la salud aducen que no han tenido aprendizaje o entrenamiento para el contexto en el que desempeñan su labor, o que este ha sido insuficiente.

Además, a pesar de haber adquirido, al menos teóricamente, una sólida formación basada en el método científico, estos profesionales se ven bombardeados por una gran cantidad de información sobre nuevas terapias y métodos asistenciales, que en algunos casos podrían clasificarse como pseudociencias, y a los que les es a veces difícil detectarlas como tales.

El objetivo general del Proyecto de Innovación fue fomentar la participación activa de los estudiantes en la construcción del conocimiento, así como desarrollar estrategias didácticas para su aprendizaje autónomo y diseñar procesos activos de adquisición de habilidades y destrezas para su desempeño profesional. Asimismo, y en respuesta a la demanda de tener futuros profesionales biomédicos mejor formados en habilidades comunicativas, fomentando, además, el pensamiento crítico de los mismos, la presente experiencia innovadora ha pretendido paliar las carencias en ambos ámbitos que los propios egresados declaran, mediante su mejora en el alumnado participante a través de la combinación de metodologías docentes innovadoras como son la clase invertida y el debate formal. En este sentido, la utilización del debate formal como método innovador de enseñanza/aprendizaje se ha demostrado como una herramienta eficaz para desarrollar la capacidad de razonamiento y la comunicación lógica del estudiantado (Paredes y cols., Proceedings of ICERI2017 Conference, 7861-7864, 2017), por lo que su combinación con la metodología de la clase invertida ofrecía las mejores posibilidades para conseguir el objetivo general planteado en el Proyecto. Además, la actividad propuesta, que combinaba herramientas innovadoras en el ámbito de la enseñanza universitaria en Ciencias de la Salud como son la clase invertida y el debate formal, se eligió para fomentar también el desarrollo de competencias transversales o generales, que forman parte del currículo de la mayoría de los nuevos Grados relacionados con las Ciencias Biomédicas y de la Salud desarrollados en el marco del Espacio Europeo de Educación Superior, puesto que estas competencias son de carácter interdisciplinar y básico y, por tanto, deberían desarrollarse en todas las ramas del conocimiento, pues son en realidad un reflejo de algunas de las Competencias Clave fijadas en 2006 por la Comisión Europea.

Por útlimo, otro objetivo principal del Proyecto fue que este fuera claramente de aplicación en ramas del conocimiento biomédico variadas. Así, desde su origen la propuesta se ideó y elaboró por profesorado de distintas áreas de conocimiento de Ciencias de la Salud (Bioquímica y Biología Molecular, Cirugía, Farmacología y Toxicología, Fisiología, Medicina y Cirugía Animal). El hecho de que el grupo estuviera formado por un equipo de docentes diverso propició el trabajo colaborativo y el intercambio y aprendizaje de tácticas innovadoras en los varios campos del conocimiento biomédico básico y clínico que confluyeron en la actividad innovadora. Además, el equipo solicitante ya colaboraba activamente en Proyectos de Innovación, lo que influyó positivamente a la hora de incorporar al alumnado a la actividad docente innovadora propuesta, pues los Proyectos en los que participaban no eran ajenos a ningún miembro del equipo.

## 2. Objetivos alcanzados

En un sentido amplio, el principal objetivo alcanzado fue poner en práctica una actuación innovadora como la que constituye la clase invertida para fomentar la participación activa del estudiantado en la construcción de su propio conocimiento, además de desarrollar estrategias didácticas para su aprendizaje autónomo y diseñar procesos activos de adquisición de competencias y capacidades para su desempeño profesional. Así, el Proyecto se centró en desarrollar el razonamiento crítico y autocrítico del alumnado y su capacidad de adaptarse a una situación tan novedosa como la que propone la clase invertida en combinación con el debate formal. En este sentido, el alumnado no fue un mero actor pasivo en el sentido de que no se permitió el uso de los materiales proporcionados por el profesorado, sino que se fomentó que buscara, se documentara y elaborara material propio, que fue compartido con el resto de grupos participantes, y posteriormente discutido en la clase. Siendo conscientes de la dificultad que esto implicaba, los temas que se trataron se limitaron a los que se abordaban en las clases de seminario y contaron en todo momento con el asesoramiento, guía y tutorización del profesorado participante. Para tal fin, el alumnado aprendió a gestionar previamente las fuentes elegidas para la elaboración del material que se expuso. El tema tratado fue, una vez concluida la sesión de aplicación de conocimientos, sometido a debate por el resto de la clase, por lo que tanto el alumnado que actuó como docente, como el que actuó como discente, confeccionó, a su vez, un argumentario a favor o en contra del tema elegido mediante el uso de bases de datos, repositorios, artículos, monografías, etc. Dicho argumentario, al igual que los materiales elaborados en la fase previa, siguió los principios de rigor y calidad científicos, incorporando a su vez los principios éticos que rigen la investigación científica y la práctica profesional. Asimismo, el Proyecto fomentó la capacidad de trabajo tanto autónomo como en equipo del alumnado, con el fin de progresar en habilidades para el trabajo en grupos multidisciplinares, además de que adquiriera capacidad de toma de decisiones y mostrara creatividad, iniciativa y espíritu emprendedor.

En un sentido más estricto circunscrito a las competencias que los estudiantes de Ciencias de la Salud deben adquirir durante sus estudios universitarios pero que los egresados consideran que deberían abordarse con mayor profundidad y dedicarles un tiempo mayor, el presente Proyecto de Innovación abordó y mejoró los aspectos que se listan a continuación y que también pueden considerarse como objetivos alcanzados:

1. Comunicarse de modo efectivo y claro, tanto de forma oral como escrita, con los pacientes, los familiares, los medios de comunicación y otros profesionales.
2. Establecer una buena comunicación interpersonal que capacite para dirigirse con eficiencia y empatía a los pacientes, a los familiares, medios de comunicación y otros profesionales.
3. Redactar y comunicar registros biomédicos de forma comprensible a terceros.

4. Conocer, valorar críticamente y saber utilizar las fuentes de información clínica y biomédica para obtener, organizar, interpretar y comunicar la información científica y sanitaria.

5. Tener en la futura actividad profesional un punto de vista crítico, creativo, con escepticismo constructivo y orientado a la investigación y al método científico.

6. Comprender la importancia y las limitaciones del pensamiento científico en el estudio de los diversos campos que componen las Ciencias de la Salud.

Con el fin de evaluar si los objetivos mencionados anteriormente se correspondían con las expectativas del propio alumnado participante en cuanto a su participación en el Proyecto, se elaboraron encuestas diseñadas para analizar diversos aspectos de la experiencia de aprendizaje del alumnado durante el proceso de desarrollo del mismo. Se pidió a los estudiantes que puntuaran cada pregunta de 0 a 3, siendo 0 la puntuación mínima y 3 la máxima. En general, la propuesta inicial de clase invertida en combinación con una experiencia de debate formal fue considerada positivamente por el alumnado. Aunque nuestros resultados confirmaron que era una alternativa factible y útil al aula tradicional (Paredes y cols., Proceedings of ICERI2018 Conference, 6140-6146, 2018), el alumnado estaba más interesado en la posibilidad de aumentar su capacidad de análisis, mejorar sus habilidades de comunicación oral y escrita y entrenar su capacidad de obtener información que en desarrollar una actitud crítica hacia la investigación o mejorar su capacidad de resolución de problemas (Rancan y cols., Proceedings of INTED2019 Conference, 7809-7812, 2019). A pesar de ello, se abordaron todos los aspectos inicialmente propuestos.

Por otro lado, y en cuanto a la propia participación en el Proyecto, en general, los participantes alcanzaron los principales objetivos de la actividad de innovación en relación con la mejora de las habilidades de comunicación y el pensamiento crítico en respuesta a la demanda de que los futuros profesionales de la biomedicina estén mejor formados en estas áreas. En particular, parece que su participación en el Proyecto de Innovación fue capaz de aumentar sus capacidades de análisis, síntesis y organización; mejorar sus habilidades de comunicación oral y escrita, capacitarlos para encontrar fuentes de información creíbles, mejorar sus capacidades para resolver problemas y tomar decisiones, mejorar su capacidad para trabajar en equipos interdisciplinares, así como para desarrollar y mejorar sus habilidades en las relaciones interpersonales, desarrollar una actitud crítica basada en los principios del método científico hacia la investigación y los artículos científicos, ayudarlos a aprender de forma autónoma y a adaptarse a nuevas situaciones, aumentar su creatividad e iniciativa para aumentar sus conocimientos sobre los temas de las Ciencias de la Salud y aumentar su motivación por la calidad de la información (Paredes y cols., Proceedings of ICERI2018 Conference, 5914-5918, 2018).

## 3. Metodología empleada en el proyecto

En primer lugar, se proporcionó al alumnado las directrices necesarias para la elaboración de los materiales que se compartirían con la clase. Además, como cada sesión sería, una vez finalizada la fase de aplicación de conocimientos, sometida a debate, se enseñaron previamente las pautas que debían seguirse para poder defender o refutar los temas con éxito en el contexto del debate formal, familiarizando al alumnado con las técnicas y normas empleadas en el mismo. A continuación, se hizo la selección de temas, cuyo requisito fue que debían ser propuestos por el propio alumnado, pues es sabido que el nivel de motivación e implicación se incrementa significativamente cuando el alumnado debe investigar y defender, o refutar, ideas que le son interesantes o le despiertan curiosidad. Los temas estaban relacionados con el temario impartido y encaminados a fomentar el pensamiento crítico y el uso del método científico a la hora de elaborar conclusiones. Se hizo, por tanto, énfasis en aquellas cuestiones controvertidas o que causaban dilema, especialmente las consideradas como pseudociencias, pero que el público general y el alumnado de Ciencias de la Salud en particular, puede, peligrosamente, no identificar como tales. El alumnado además, acordó en conjunto la asignación de los temas a los grupos que se crearon y elaboraron el calendario de clases de aplicación de conocimientos-debates. En la clase invertida clásica, es el profesorado el que prepara los materiales del curso que deben trabajarse previamente, como puede ser la grabación de la clase magistral, materiales complementarios para el estudio, elaboración de preguntas relevantes, etc. El presente Proyecto de Innovación pretendió dar un paso más y que fuera el propio alumnado el que preparara los materiales de cada tema elegido para los distintos seminarios. Así, el alumnado fue protagonista en todo momento de su proceso de enseñanza-aprendizaje. Sin embargo, considerando que esto podría crear, en algunas ocasiones, desacuerdos entre los estudiantes o bien no tomar éstos la iniciativa necesaria, a determinados alumnos participantes se les dio el papel de vínculo entre sus compañeras y compañeros y el profesorado. Asimismo, todo el proceso estuvo estrechamente supervisado por el profesorado, con cuyo asesoramiento y tutorización contó cada grupo participante en cualquier aspecto que hubo que tratar, bien fuera la preparación de los materiales, las fuentes que se debían consultar para obtener la información necesaria para la elaboración de los mismos y de la sesiones de debate, etc. Además, el profesorado actuó en el aula, por un lado, como moderador-facilitador de las sesiones de debate, y por otro, como coordinador de contenidos, solucionando a tiempo real las dudas o cuestiones difíciles que fueron apareciendo y que los grupos participantes no fueron capaces de solventar. Finalmente, el profesorado trasladó al alumnado preguntas cortas, pero directas, sobre el tema particular en el que se había trabajado, con el fin de asimilar y evaluar el proceso de aprendizaje. El alumnado discente también calificó razonadamente al alumnado docente, lo que a su vez sirvió al profesorado para calificar al grupo-clase.

## 4. Recursos humanos

El grupo de profesorado participante estuvo compuesto por 10 integrantes pertenecientes a Departamentos y Secciones departamentales de las Facultades de Medicina y Veterinaria de la UCM, específicamente a los de Bioquímica y Biología Molecular (Dras. Elena Vara Ameigeiras, Cruz García Martín, Lisa Rancan y Dr. José Antonio Zueco Alegre), Cirugía (Dres. Carlos Mª Simón Adiego, José Manuel Asencio Pascual y Luis Javier Huerta Martínez), Farmacología y Toxicología (Dr. Ignacio Garutti Martínez), Fisiología (Dr. Sergio Damián Paredes Royano, que actuó como investigador principal y coordinador del proyecto) y Medicina y Cirugía Animal (Dr. Gonzalo Marañón Pardillo) con el fin de englobar estudiantado de al menos una parte representativa de cada una de las áreas principales de conocimiento a las que estaban adscritos los integrantes del equipo solicitante y proporcionar al equipo de trabajo más información a la hora de abordar el Proyecto en situaciones diversas en cuanto a contextos educativos equivalentes pero no idénticos. Asimismo, considerando que en algunas ocasiones durante el desarrollo del proyecto se podía hacer necesaria la intervención del profesorado al producirse desacuerdos entre los estudiantes o no tomar estos la iniciativa necesaria, lo que incluso podría llegar a cohibirlos, pues quizás se verían obligados a elegir determinados temas que en realidad no les convencían totalmente, se propuso que 3 de los alumnos, Alberto Alonso González, Sergio Valdés López-Linares y Elena Valdivielso Suárez, fueran también solicitantes del Proyecto, otorgándoles un papel muy importante, pues hicieron de vínculo entre sus compañeros y el profesorado. En el grupo solicitante se combinaron docentes con más de 30 años de experiencia en la Universidad con profesorado joven, tanto desde el punto de vista del comienzo de impartición de clases como por la fecha de defensa de la tesis doctoral. Sin duda alguna, la heterogeneidad de los antecedentes de ambos grupos fue clave para debatir, intercambiar y consensuar estrategias pedagógicas útiles de acuerdo a la pluralidad de conocimientos y experiencias del equipo, lo que redundó en la toma de las mejores decisiones a la hora de implementar la propuesta. Cabe destacar que algunos miembros del equipo solicitante ya habían colaborado activamente en proyectos de innovación del Vicerretorado de Calidad de la UCM (convocatorias PIMCD de 2013, 2014, y 2015, e Innova-Docencia de 2016-2017 y 2017-2018), lo que influyó positivamente a la hora de implicar al alumnado en la actividad docente innovadora propuesta. Este hecho quedó claramente reforzado por la posibilidad que ofrecía la convocatoria de incorporar alumnado como solicitante, y que hizo suya el Proyecto, convirtiéndose junto al profesorado, por tanto, en organizador primario para la puesta en marcha del mismo. Asimismo, existían un importante número de actividades previamente consensuadas y trabajadas por el equipo solicitante, primando en muchas ocasiones el carácter transversal de las mismas. Además, la diversidad del profesorado posibilitó debatir, intercambiar y consensuar criterios y estrategias pedagógicas útiles de acuerdo a las características de la formación impartida, lo que condujo también a abordar el desarrollo de las competencias transversales del alumnado participante.

## 5. Desarrollo de las actividades

El desarrollo del proyecto se estableció en torno al siguiente plan de trabajo:

El investigador principal y coordinador del grupo estuvo a cargo de las siguientes tareas:

1) Revisión de experiencias previas sobre uso de la clase invertida en combinación con el debate formal como herramienta de innovación docente para el desarrollo temprano de las habilidades de comunicación y el análisis crítico de los estudiantes de Ciencias de la Salud.

2) Convocatoria y moderación de las reuniones del equipo solicitante del Proyecto.

3) Distribución, seguimiento y apoyo en las diversas tareas del Proyecto.

4) Elaboración de informes de Proyecto.

El equipo de trabajo de forma conjunta estuvo a cargo de las siguientes tareas:

5) Selección previa de posibles temas susceptibles para la sesiones combinadas de clase invertida y debate formal.

6) Diseño y planificación de las diferentes sesiones combinadas de clase invertida y debate formal.

7) Establecimiento de criterios comunes que se deberían seguir para conseguir los objetivos propuestos en las diferentes sesiones combinadas de clase invertida y debate formal.

8) Organización de los grupos participantes.

9) Asignación de los temas para las sesiones combinadas de clase invertida y debate formal y tareas a cada grupo, atendiendo a las preferencias que cada uno mostró de acuerdo a los contenidos cursados en sus respectivos Grados.

10) Asesoramiento y supervisión del alumnado en las tareas de preparación de las sesiones combinadas de clase invertida y debate formal y, en su caso cuando fue necesario, en los ensayos previos a las mismas.

11) Recopilación, tratamiento, preparación y difusión de los resultados del proyecto en diferentes jornadas, encuentros y congresos sobre Innovación y Calidad Docente Universitaria.

12) Elaboración de informes para establecer mejoras en los siguientes cursos académicos en donde se repita la actividad docente innovadora propuesta.

Todo el aprendizaje al que se refiere el plan de trabajo fue tutelado por el profesorado integrante del Proyecto que, de modo general, realizó tutorías con los estudiantes de dos formas: En grupos reducidos, focalizando el trabajo en cada sesión combinada de clase invertida y debate formal y presentación en particular, y en grupos más grandes, abarcando a todos participantes, donde profesorado y alumnado reflexionaron conjuntamente sobre el trabajo realizado y se ayudó a la mejora constructiva de las sesiones combinadas de clase invertida y debate formal que llevarían a cabo públicamente.

En cuanto a la viabilidad de la actividad docente innovadora descrita en la presente memoria, esta se encontró siempre garantizada, pues tuvo lugar en las aulas de la Facultad, dentro de la programación docente y en el horario destinado a los seminarios. Las experiencias de éxito desarrolladas previamente por el equipo solicitante, gracias a los proyectos concedidos en anteriores convocatorias de PIMCD e Innova-Docencia del Vicerrectorado de Calidad de la UCM, fueron referencia para que el Proyecto solicitado se pusiera en marcha y desenvolviera en las mejores condiciones.

El equipo desde tempranamente en su trayectorias ha asumido como prioridad, además de su trabajo como investigadores en Biomedicina, su formación en la mejora docente, asistiendo a espacios de intercambio docente como jornadas, congresos y encuentros, además de participar en proyectos y actividades de innovación docente que persigan la renovación de la docencia universitaria, la mejora de su calidad y la adaptación a la convergencia del Espacio Europeo de Educación Superior. En dichos foros, los miembros del equipo han dado a conocer los resultados de sus Proyectos de Innovación educativa, siendo incluso organizadores de encuentros derivados de experiencias docentes innovadoras, por lo que su experiencia en la difusión y transferencia de resultados en este campo es amplia. Por tanto, y como se mencionó anteriormente, fue también objetivo del Proyecto realizar un plan de difusión y transferencia de los resultados obtenidos en eventos y publicaciones sobre innovación docente, semejante a los llevados a cabo en experiencias anteriores. Así, los resultados del proyecto se prepararon y difundieron en eventos sobre Innovación y Calidad Docente Universitaria de prestigio, de carácter multidisciplinar e internacional, siendo comentados y compartidos con otros colegas de universidades y centros de educación superior. La intención última del equipo de trabajo fue que otras instituciones universitarias en donde se imparten Grados relacionados con las Ciencias de la Salud y afines pudieran reproducirlos. En este sentido, la actividad docente innovadora no solo contribuiría a la formación y mejora de las capacidades del alumnado participante, sino de modo global podría ser un referencia más que demostrara la mejora de las habilidades de comunicación del estudiantado de los Grados de Medicina, Nutrición Humana y Dietética, Odontología, Veterinaria y otras Ciencias Biomédicas del ramo, a través de este tipo de actividades.

Particularmente, los resultados se presentaron en la 11ª Conferencia Internacional de Educación, Investigación e Innovación (ICERI), organizada por la International Academy of Technology, Education and Development (IATED), que tuvo lugar los días 12, 13 y 14 de noviembre de 2018 en Sevilla y la 13ª Conferencia Internacional sobre Tecnología, Educación y Desarrollo (INTED), organizada en Valencia durante los días 11, 12 y 13 de marzo de 2019 también por la IATED. Los títulos de las comunicaciones presentadas fueron los siguientes:

i) Paredes, S.D., Rancan, L., García, C., Asencio, J.M., Garutti, I., Huerta, L., Marañón, G., Simón, C., Zueco, J.A., Vara, E. Flipped classroom combined with formal debate as a strategy to improve communication skills and critical thinking in Health Science students (Comunicación ID 2395). 11th International Conference of Education, Research and Innovation (ICERI), Sevilla, 2018.

ii) Paredes, S.D., Rancan, L., García, C., Asencio, J.M., Garutti, I., Huerta, L., Marañón, G., Simón, C., Zueco, J.A., Vara, E. Qualitative analysis of expectations of medical students on their participation in an innovation activity combining formal debate with flipped classroom (Comunicación ID 2442). 11th International Conference of Education, Research and Innovation (ICERI), Sevilla, 2018.

iii) Rancan, L., Paredes, S.D., García, C., Asencio, J.M., Garutti, I., Huerta, L., Marañón, G., Simón, C., Zueco, J.A., Vara, E. A survey study exploring opinions of second-year medical students on their participation in a formal debate with flipped classroom activity (Comunicación ID 1930). 13th International Technology, Education and Development Conference (INTED), Valencia, 2019.

iv) Rancan, L., Paredes, S.D., García, C., Vara, E. Bringing science and society closer together and promoting scientific vocations: an educational experience within the Madrid science and innovation week (Comunicación ID 1931). 13th International Technology, Education and Development Conference (INTED), Valencia, 2019.

La primera y la segunda fueron además publicadas en los Proceedings of ICERI2018 Conference 5914-5918 y 6140-6146 IATED Academy (I.S.B.N.: 978-84-09-05948-5), 2018, mientras que la tercera y la cuarta lo fueron en los Proceedings of INTED2019 Conference IATED Academy (I.S.B.N.: 978-84-09-08619-1), 2019, siendo su paginación, respectivamente, 7809-7812 y 7813-7816.

## 6. Anexos

Los siguientes anexos incluyen los productos generados y publicados en los eventos sobre innovación y mejora de la calidad docente que han sido mencionados en el apartado anterior.

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# FLIPPED CLASSROOM COMBINED WITH FORMAL DEBATE AS A STRATEGY TO IMPROVE COMMUNICATION SKILLS AND CRITICAL THINKING IN HEALTH SCIENCE STUDENTS

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## Abstract

Health Science schools face the challenge of transforming biomedical education radically in order to prepare undergraduates better for basic research and clinical practice in such a dynamic environment as health care. To achieve this, University professors need to develop effective strategies to facilitate learning and involve students in active and self-directed teaching. Literature indicates that the use of the master class is no longer a fully successful method for students who are currently enrolled at University. In this context, the flipped classroom has been described as an adequate strategy so that University students can reach the learning goals that are part of the degree program. Flipping the classroom means that students gain first exposure to new material outside of class, usually via reading or lecture videos, and then use class time to do the harder work of assimilating that knowledge, through problem-solving, discussion, or debates. On the other hand, the use of formal debate as an innovative method of teaching and learning seems to be an effective tool to develop the capacity of reasoning and logical communication of students. Particularly, the Karl-Popper debate format focuses on relevant propositions that are often inherently divisive, which emphasizes the development of critical thinking skills and tolerance for different points of view. Thus, in Karl-Popper debate sessions a controversial subject is taken and framed as a resolution statement (e.g., a proposal or recommendation). Subsequently, one group of students is required to affirm the resolution and another group has to argue against that resolution. Although there is evidence that proposes this methodology as a successful model in various subjects of other areas of knowledge, the number of publications that describe the use of Karl-Popper formal debate together with flipped classroom in Health Science contexts is still limited. This combination appears to offer the best possibilities to improve communication skills and critical thinking of students in response to their demand of having future biomedical professionals better trained in these fields.

Keywords: Communication skills, Critical thinking, Formal debate, Flipped classroom, Health Sciences.

## 1 INTRODUCTION

Instructional or formal debate is a methodology that incorporates the theory of learning along life together with the active participation of students. Using formal debate in higher education has been associated with improving communication and empathy, critical-thinking ability, literature searching, and application of evidence, teamwork, and self-directed learning [1]. Debates allow students an opportunity not only to identify that there is an issue to resolve, but also to demonstrate a deeper analysis of the issue, including appraisal, critique, and reasoning of the issue for a potential solution [2]. This teaching tool is currently an accepted form of teaching method in various professional schools and faculties of Health Sciences in several countries, with successful experiences being described for a long time [3], although its use in the specific field of Biomedical Sciences is still limited [4].

There are a number of debate formats, allowing a different approach to debated subject and involving a different number of participants. One of the most popular formats include the Karl-Popper debate format. Karl-Popper debate format focuses on relevant propositions that are often inherently divisive, which emphasizes the development of critical thinking skills and tolerance for different points of view. Thus, Karl-Popper debate sessions involve taking a controversial subject, framing it as a resolution statement (e.g., a proposal or recommendation), and requiring one group of students to affirm the resolution and another group to argue against the resolution. Students are asked to present their arguments in a prearranged and timed format, alternating point/counterpoint [5]. In this regard, each team participating in a discussion session investigates both sides of each position, trying to identify

their own strengths and weaknesses. This ensures a high level of argumentation, as expected in an activity conceived for a university context [4, 6, 7].

The flipped classroom approach has received much attention in medical education [8]. In fact, the flipped classroom has been described as an effective strategy to better prepare graduates for basic research and clinical practice in the dynamic health care environment [9]. The term flipped classroom was coined in 2012 [8, 10] and has gained popularity worldwide [11]. This learning innovative methodology requires students to obtain background knowledge through homework prior to a face-to-face class meeting, and reserves class time for applying knowledge to solve real basic research and clinical problems through discussion facilitated by faculty [12]. This is the opposite of the traditional lecture-based classroom, in which students attend didactic lectures where they obtain knowledge passively from the instructor, then study the content and complete assignments after class. It is also suggested that the flipped classroom promotes the integration of independent learning and use of technology outside the classroom, and learner-centered activities and more efficient student-teacher interactions inside the classroom [8].

The deficiencies in communication skills and emotional management in the Health Science-related professions are a confirmed reality. In fact, health professionals claim that they have not had any learning or training for contexts in which they perform their work, or that this has been insufficient. In addition, despite having acquired, at least theoretically, a solid formation based on the scientific method, these professionals are bombarded by a large amount of information on new therapies and healthcare methods, which in some cases could be classified as pseudosciences. Moreover, they report that they sometimes have difficulty in detecting and determining the boundary between science and pseudoscience.

Here, we present an innovation experience/project aimed at alleviating the afore-mentioned shortcomings. As stated before, the use of formal debate as an innovative method of teaching/learning has been shown as an effective tool to develop the capacity of reasoning and logical communication of students. Its combination with the methodology of the flipped classroom may offer better possibilities to achieve the objective of improving communication skills and promoting critical thinking.

## 2 METHODOLOGY

Taking into account previous experience of participating professors [4], the objective of the project was to put into practice an innovative action such as combining the flipped classroom with Karl-Popper debate format in order to encourage the active participation of students in the construction of their own knowledge, as well as to develop didactic strategies for their autonomous learning and design processes assets for the acquisition of skills and abilities for their professional performance. Thus, the project focused on developing the critical and self-critical thinking of students and their ability to adapt to a situation as new as that proposed by the flipped classroom in combination with formal debate. Participating students were not considered mere passive actors. Therefore, they could not use the materials provided by professors, but they had and were encouraged to search, compose and prepare their own material, which had to be shared with the rest of the participating student groups, and later discussed in the class. Being aware of the difficulty that this may imply, the discussed topics were limited to those addressed in seminar lectures. Furthermore, students had at all times the advice, guidance and tutoring of the participating professors.

Students had to learn to manage previously-chosen sources for the preparation of the material that would be shown. Once the session of “application of knowledge” or learning was finished, the specific topic was debated with the rest of the class, so that both students who acted as teachers and those who acted as students had, in turn, to prepare arguments for or against the chosen topic. The preparation was carried out through the use of databases, repositories, research articles, monographs, etc. Like the materials elaborated in the previous phase, arguments were required to follow the principles of scientific rigor and quality, incorporating the ethical principles that govern scientific research and professional practice. The project also aimed to promote the ability to work independently and as a team in order to progress in skills for working in multidisciplinary groups, as well as acquiring decision-making capacity and showing creativity, initiative and entrepreneurial spirit.

In the frame of the competences that Health Science students should acquire during their University studies but that post-graduates consider that they should be addressed in greater depth and dedicate a longer time to them, the innovation experience aimed to address and improve the following aspects:

1 To communicate effectively and clearly, both orally and in writing, with patients, family members, the media and other professionals.

2 To establish a good interpersonal communication that enables to address with efficiency and empathy to patients, family members, media and other professionals.

3 To elaborate and communicate biomedical records in a comprehensible manner to third parties.

4 To learn and assess critically how to use clinical and biomedical information sources to obtain, organize, interpret and communicate scientific and health information effectively.

5 To have a critical and creative point of view in the future professional activities, showing constructive skepticism and knowledge/opinions based on research and the scientific method.

6 To understand the importance and limitations of scientific thinking in the study of the different Health Science fields.

Firstly, the necessary guidelines for the elaboration of the materials that would be shared with the class were provided to students. These guidelines had to be followed to defend or refute the topics successfully. For this reason, the characteristics of Karl-Popper debate format were taught previously. Thus, students had the opportunity to learn the techniques and standards used in this formal debate type.

The selection of topics was proposed by the students themselves since it is known that the level of motivation and involvement is significantly increased when students must investigate and defend, or refute, ideas that are interesting or curious to them. The topics were related to the syllabus of the subjects taught throughout the course and aimed at promoting critical thinking and the use of the scientific method when drawing conclusions. Therefore, emphasis was placed on controversial issues or topics that cause a dilemma, especially those considered as pseudosciences, but that the general public and the Health Science students of Health Sciences in particular, cannot identify as such. Homeopathy, the miraculous mineral supplement (MMS), or apitherapy were some of the topics debated in the sessions. The students as a whole had, in addition, to agree on the assignment of the topics to the groups that were formed and to elaborate the calendar of application of knowledge-debate classes.

In the classical flipped classroom, the faculty prepare the course materials beforehand, including the recording of the master class, complementary materials, elaboration of relevant questions, etc. In this innovation project, we went one step further so that students themselves had to prepare the materials for each topic chosen for the different seminars. Thus, students were protagonists at all times of their teaching-learning process. However, these decisions may create, on some occasions, disagreements among the students, who may not take the necessary initiative. That is why we included students who acted as a link between their classmates and professors. Some of these students had already collaborated with the participating professors in previous innovative teaching activities where formal debate had been used as a teaching method, and others had experience in the flipped classroom methodology in pre-university stages. In any case, the entire process was closely supervised by professors, who advised and tutored each participating group in any aspect that needed to be addressed, i.e., preparation of materials, sources that should be consulted to obtain the necessary information for the preparation of materials and the debate sessions, etc. In addition, the faculty also acted in the classroom, on the one hand, as moderators-facilitators of the debate sessions, and on the other, as content coordinators, solving in real time doubts or difficult issues that participating groups had not been able to solve. Finally, professors addressed short, but direct questions to the students about the particular topic in which they had worked, in order to assess and evaluate the learning process. Likewise, audience students had to grade the teaching students reasonably. This served professors to grade the group-class.

## 3 RESULTS

Regarding the innovation activity presented here, we believe that, overall, the main goals of the innovation activity in relation to improve communication skills and critical thinking in response to the demand to have future biomedical professionals better trained in these areas in our students were achieved. In particular, it seems that their participation in the innovation project was able to increase their analysis, synthesis, and organizational abilities; improve their oral and written communication skills, train them in finding credible information sources, improve their capabilities to solve problems and make decisions, improve their ability to work in interdisciplinary teams as well as develop and

upgrade their skills in interpersonal relationships, develop a scientific-oriented, critical attitude towards research and scientific reports, help them learn autonomously and adapt to new situations, augmented their creativity and initiative for increasing their knowledge on Health Science topics, and increase their motivation for the quality of information. However, in order to have reliable results on this particular aspect, a general evaluation of the whole activity should be carried out. Although it seems that participating in the innovation activity increased student motivation in the subject and degree, and helped students develop competences that other methodological strategies do not allow, perceptions of students towards using formal debate combined with flipped classroom as a strategy to improve curricular and cross-curricular competences should be assessed as well.

## 4 CONCLUSIONS

The most effective approach to improve teaching efficiency is to promote active learning, which requires students to actively engage with learning materials, participate in the class, and collaborate with other classmates [12]. A large body of literature has reported that this can be reached through the application of flipped classroom. Although this blended learning strategy has been used by a number of branches of knowledge for several years, adopting this model has been slower in disciplines that traditionally depended on lecture to teach information. In Health Science education, flipped classroom has been used in a variety of disciplines, including nursing, pharmacology, physiology, radiology, epidemiology, and stomatology [8]. More recently, the flipped classroom approach has been extended to medical clerkship teaching with encouraging results, such as clerkships in emergency medicine and surgery [13, 14]. However, the application of the flipped classroom in combination with other teaching-learning innovation systems such as Karl-Popper debate format is less well studied. Here, we have presented an innovation project showing that combining both strategies may be useful in improving communication skills and critical thinking in Health Science students. The activity appears to be applicable in various fields of biomedical knowledge. Finally, the viability of the activity that is described in the present innovation project also seems to be guaranteed because it takes place in the university school classrooms, within the teaching program and in the schedule for the seminars.

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# QUALITATIVE ANALYSIS OF EXPECTATIONS OF MEDICAL STUDENTS ON THEIR PARTICIPATION IN AN INNOVATION ACTIVITY COMBINING FORMAL DEBATE WITH FLIPPED CLASSROOM

**S.D. Paredes[1], L. Rancan[1], C. García[1], J.M. Asencio[2], I. Garutti[2], L. Huerta[2], G. Marañón[1], C. Simón[2], J.A. Zueco[1], E. Vara[1]**

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## Abstract

The traditional classroom lecture is still commonly used in undergraduate medical education. However, classroom lectures can be considered teacher-centered strategies that are conducive to passive learning on behalf of learners. For this reason, there are calls for a shift in medical education away from the traditional lecture approach and toward other instructional approaches that encourage higher-order thinking and active participation from students. One such approach that has received much attention is the flipped classroom, which allows students to independently learn foundational concepts as required homework, and then use this gained knowledge during class time to engage in critical thinking opportunities and application of knowledge. In the flipped classroom model, learners are first exposed to educational content prior to formal class sessions via readings, videos, or other electronic exercises that have been formally assigned. Given that students have already acquired knowledge through this initial phase, the subsequent classroom time is dedicated to activities that allow students to apply their knowledge to challenging problems in a setting that promotes collaboration with peers and feedback and direction from professors. In addition, using formal debate in higher education appears to be a useful tool to prepare students to face the complexity of issues affecting the modern world and to work with individuals with different viewpoints and backgrounds. In fact, using formal debate in higher education has been associated with improving communication and empathy, critical-thinking ability, literature searching, and application of evidence, teamwork, and self-directed learning. Debates allow students an opportunity not only to identify that there is an issue to resolve, but also to demonstrate a deeper analysis of the issue, including appraisal, critique, and reasoning of the issue for a potential solution. Flipped classroom together with formal debate were proposed to medical students as innovative methodologies to improve communication skills and critical thinking in response to the demand to have future biomedical professionals better trained in these areas. The general aim of the innovation experience was to encourage the active participation of students in the construction of knowledge, as well as to develop didactic strategies for their autonomous learning and to design active processes of acquisition of skills and abilities for their professional performance. Here, we report the expectations of medical students from Complutense University of Madrid on their future participation in the afore-mentioned innovation activity. Participants considered that the experience would help them gain confidence and security when it comes to presenting scientific facts, be fluent when talking in public, and expand their knowledge on some controversial topics. Regarding the negative aspects, some showed concern about being sufficiently prepared to carry out the activity with guaranteed success, taking into account that for a significant part of the students it was the first time that they participated in an innovative activity that combined both flipped learning and formal debate.

Keywords: Communication skills, Critical thinking, Formal debate, Flipped classroom, Health Sciences.

## 1 INTRODUCTION

Since the beginning of the past century, the amount of information about health and medicine has grown significantly, the health care system has become increasingly complex, patients have become more engaged in their care, and educational innovations in technology and pedagogy have grown rapidly [1]. Yet, little has changed in the way that education is structured and delivered to aspiring health professionals, and in-class lectures continue to prevail in the vast majority of classrooms [2].

While medical, nursing, and pharmacy schools have been challenged to better prepare their students to meet the evolving health care needs of society [3-5], a growing body of literature consistently points to the need to rethink what is taking place in the classroom. Research shows that students' attention declines substantially and steadily after the first 10 minutes of class and that the average attention span of a medical student is 15 to 20 minutes at the beginning of class. Although students' attention returns in the last few minutes of class, they remember only 20% of the material presented during that time. Furthermore, passive learning in hour-long lectures often bores students and can deprive them of rich educational experiences [1].

Academic medicine currently involves the coexistence of four generations, -Traditionalists, Baby Boomers, Generation X, and Generation Y-, and each generation has a unique teaching and learning style [6, 7]. Because of the different teaching and learning styles associated with each generation, a generation gap can occur, being an obstacle to both teaching and learning [8]. Hence, Institutions of higher education are facing increased scrutiny to bridge this gap so to improve student learning and demonstrate programme effectiveness.

Students should be taught to read and learn information on their own, but they need instructors to act as coaches and mentors to stimulate and challenge their thinking, guide them in solving problems, and encourage their learning and application of the material [9]. This is also supported by Bryson and Hand [10] who established that students were more likely to engage if they were supported by educators who established inviting learning environments, demanded high results, and challenged higher order thinking. Hockings, Cooke, Yamashita, McGinty, and Bowl [11] suggest that students who are most deeply engaged will reflect, question, conjecture, evaluate and make connection between ideas. In contrast students who are disengaged appear to take a surface approach to learning by copying out notes, focusing on fragmented facts and jumping to conclusions.

For this reason, there are calls for a shift in medical education away from the traditional lecture approach and toward other instructional approaches that encourage higher-order thinking and active participation from students. One such approach that has received much attention is the flipped classroom. The flipped classroom is a student-centered approach to learning that increases active learning for the student compared to the traditional classroom approach [12]. In the flipped classroom model, students are first exposed to the learning material through didactics outside of the classroom, usually in the form of written material, voice-over lectures, or videos. During the formal teaching time, an instructor facilitates student-driven discussion of the material via case scenarios, allowing for complex problem solving, peer interaction, and a deep understanding of the concepts. A successful flipped classroom should have three goals: (a) allow the students to become critical thinkers, (b) fully engage students and instructors, and (c) stimulate the development of a deep understanding of the material [1]. Research would suggest to best engage students and to promote learning, teaching approaches that go beyond traditional lecture instruction are the most effective [13]. This is important and indeed necessary for two reasons; one, there are a suite of technologies available to enhance student learning and two, students particularly those of the current millennial generation (born after 1980) expect it. Simply, for this generation they require learning and engagement to be reactionary and immediate. In response to these expectations, universities internationally have recognised over the last ten to twenty years that in order to promote learning, maintain student engagement and to increase student satisfaction, the utilisation of technology with or without traditional pedagogical approaches is considered essential [14].

In addition, using formal debate in higher education appears to be a useful tool to prepare students to face the complexity of issues affecting the modern world and to work with individuals with different viewpoints and backgrounds. In fact, using formal debate in higher education has been associated with improving communication and empathy, critical-thinking ability, literature searching, and application of evidence, teamwork, and self-directed learning [15, 16]. Debates allow students an opportunity not only to identify that there is an issue to resolve, but also to demonstrate a deeper analysis of the issue, including appraisal, critique, and reasoning of the issue for a potential solution [17]. For this reason, we carried out an innovation experience to encourage the active participation of medical students from Complutense University of Madrid in the construction of knowledge, as well as to develop didactic strategies for their autonomous learning and to design active processes of acquisition of skills and abilities for their professional performance. In particular, it was aimed at improving their communication skills and critical thinking. Their expectations on their future participation in the afore-mentioned innovation activity are gathered in the present qualitative study.

## 2 METHODOLOGY

Flipped classroom together with formal Karl-Popper debate were proposed to medical students as innovative methodologies to improve communication skills and critical thinking in response to the demand to have future biomedical professionals better trained in these areas. Students were asked to answer a survey regarding their expectations about the proposed activity.

Firstly, the necessary guidelines for the elaboration of the materials that would be shared with the class were provided to students. These guidelines had to be followed to defend or refute the topics successfully. For this reason, the characteristics of Karl-Popper debate format were taught previously. Thus, students had the opportunity to learn the techniques and standards used in this formal debate type.

Regarding the topics for the debate sessions, students had to learn to manage previously-chosen sources for the preparation of the material that would be shown. Once the session of "application of knowledge" or learning was finished, the specific topic was debated with the rest of the class, so that both students who acted as teachers and those who acted as students had, in turn, to prepare arguments for or against the chosen topic. The preparation was carried out through the use of databases, repositories, research articles, monographs, etc.

The selection of topics was proposed by the students themselves since it is known that the level of motivation and involvement is significantly increased when students must investigate and defend, or refute, ideas that are interesting or curious to them. The topics were related to the syllabus of the subjects taught throughout the course and aimed at promoting critical thinking and the use of the scientific method when drawing conclusions. Therefore, emphasis was placed on controversial issues or topics that cause a dilemma, especially those considered as pseudosciences, but that the general public and the Health Science students of Health Sciences in particular, cannot identify as such.

Finally, professors addressed short, but direct questions to the students about the particular topic in which they had worked, in order to assess and evaluate the learning process. Likewise, audience students had to grade the teaching students reasonably. This served professors to grade the group-class.

Once the innovation activity was finished, students received an invitation to complete an e-questionnaire created with Google Docs. The completion of the survey was anonymous and non-compulsory. They were asked to mention both the advantages and benefits as well as the improvable and negative aspects that in their opinion had had to participate in the innovative teaching experience.

## 3 RESULTS

The present results correspond to medical students who coursed the subject Human Biochemistry during their second-year degree. 67 second-year medical students answered the survey. We observed that 67% of the surveyed subjects had never participated in a formal Karl-Popper debate before (Figure 1).

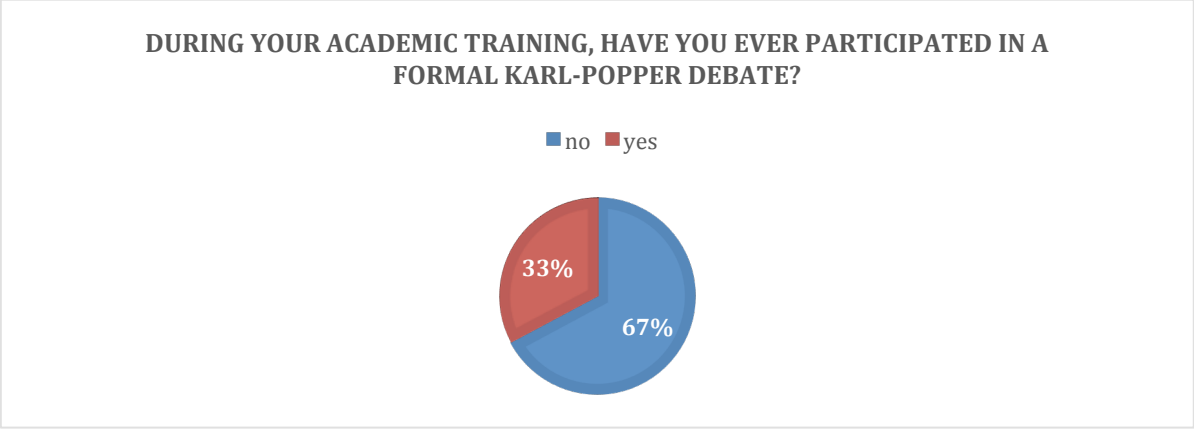


*Figure 1: Students were asked if, during their academic training, they had ever participated in a formal Karl-Popper debate.*

Among the 33% of students who had previously participated in such activity, the vast majority had been exposed to this kind of activity for the first time during high school (Figure 2).

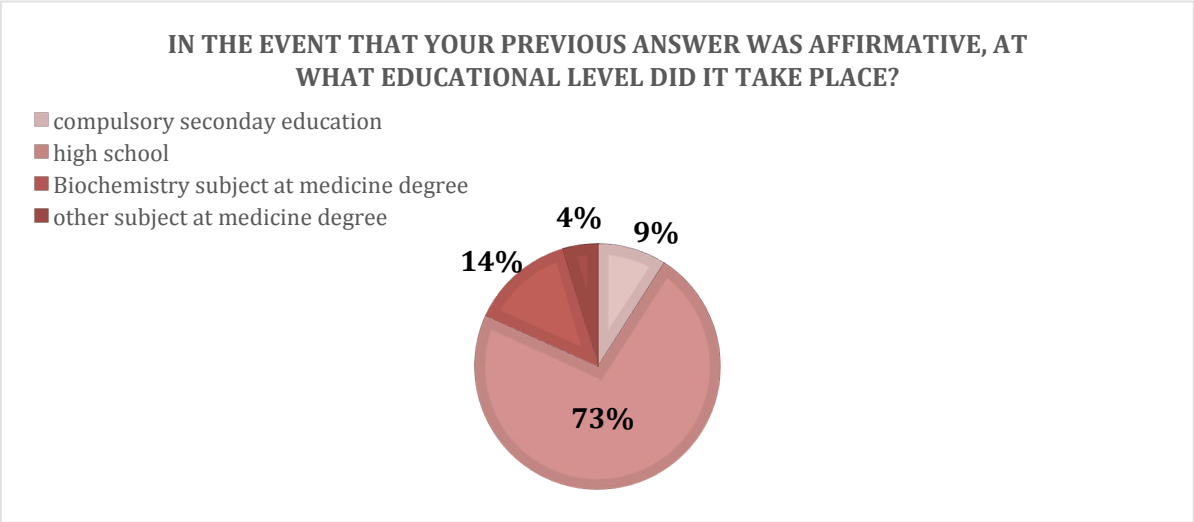


*Figure 2: Educational level at which surveyed students had been exposed to a formal debate for the first time.*

Students generally showed a positive attitude towards the proposed activity. Their expectations were high and they showed great enthusiasm. Among the positive aspects of the experience, they expected to take advantages that could be useful for their medical education as well as for their future profession. More in detail, they expected that the preparation for the debate could give them important tools exposed in Table 1. In particular, students expected to became more active and more independent, which, according to their expectations, would help them learn in a different way.

| Table 1. Positive aspects of the preparation of the debate sessions |
|---|
| Autonomous learning |
| Improvement of the synthesis capacity |
| Development of critical thinking |
| Acquisition of self-critical capacity |
| Expand biochemical knowledge |
| Learn to seeking information of a scientific nature |
| Participate in a very dynamic activity |
| Become a more active element |

In addition, students expected to obtain new skills from the debate sessions (Table 2). In particular, students expected to overcome their fear of speaking in public and in front of their colleagues. Also, they expected to improve their teamwork activities, as well as to interact and debate among each other. Moreover, they expected to gain self-control and acuteness arguing and responding to criticism.

| Table 2. Positive aspects of the debate sessions |
|---|
| Removing the fear of speaking in public and expressing oneself |
| Overcome fears to speak in front of colleagues |
| Improvement of response to unexpected situations |
| Improvement of public exposure |
| Improvement of public teamwork |
| Interact and debate with classmates |

| |
|---|
| Improvement of oral and written expression skills |
| Acuteness when arguing and responding to criticism or contrary arguments |
| Development of self-control |
| Constructive confrontation with other points of view |

Students also raised expectations that went beyond the activity per-se (Table 3). In fact, they expected that studying both points of views in order to be prepared for the debate activity would help them respect opposing opinions, value other persons' work, improve as professionals and give them view to the future.

| **Table 3. Positive aspects of the activity** |
|---|
| To improve as a professional |
| To study both points of view before the debate sessions |
| View to the future |
| Training of respect for opposing opinions |
| Learning to have to value another person's work objectively |

On the other hand, students also expected negative things from the proposed activity (Table 4). In particular, they feared that it would require a lot of extra work. Also, they felt that they could obtain wrong information or miss important details. At the same time, they were worried that the lack of an example to follow and the inexperience in the preparation of this kind of activities would prevent them from doing an outstanding job. We also observed that students were afraid that this activity would enhance the competition among them, which, according to them, is already too high. For this same reason, they massively expressed concern about being evaluated by their peers.

| **Table 4. Negative aspects of the activity** |
|---|
| Need of a lot of time and extra work |
| Possibility of obtaining wrong information or missing important details |
| The evaluation in the form of a score |
| Subjectivity of the evaluation of the debate by peers |
| Too short time per slide |
| Too much competition |
| Limitation of the possibility of doing an outstanding job |
| Lack of examples to follow |
| Need of increasing the follow-up of the preparation of the debate sessions |
| Inexperience in the preparation |

## 4 CONCLUSIONS

Literature tells that one of the primary components of effective teaching is student engagement and that engagement is critical for learning. Active learning exercises, such as teamwork, debates, self-reflection, and case studies, that prompt students' engagement and reflection encourage them to explore attitudes and values, while fostering their motivation to acquire knowledge and enhance skills [18]. Evidence shows that engaging students in active learning enhances their learning outcomes and improves their motivation and attitudes. Moreover, active learning stimulates higher-order thinking, problem solving, and critical analysis while providing feedback to both the student and instructor [19]. Generally speaking, medical students perceived the debate format combined with the flipping classroom as a useful instructional tool. These results will assist professors to improve the development of this innovation activity once it will be implemented.

## ACKNOWLEDGEMENTS

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# A SURVEY STUDY EXPLORING OPINIONS OF SECOND-YEAR MEDICAL STUDENTS ON THEIR PARTICIPATION IN A FORMAL DEBATE WITH FLIPPED CLASSROOM ACTIVITY

**L. Rancan[1], S.D. Paredes[1], C. García[1], J.M. Asencio[2], I. Garutti[2], L. Huerta[2], G. Marañón[1], C. Simón[2], J.A. Zueco[1], E. Vara[1]**

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## Abstract

The flipped classroom model is a student-centered learning approach that increases student active learning as compared to traditional classroom-based instruction. Flipped classroom aims at allowing students to become critical thinkers, engaging them and instructors in the teaching and learning process, stimulating the development of a deep understanding of the subject. In this regard, there is increasing pressure for Higher Education institutions to undergo transformation, to adapt in ways that meet the conceptual needs of present time, promoting, among others, the flipped learning approach. However, this approach requires more independent work from students who, in Medical School, are often more focused on final exam marks than in knowledge acquisition itself. Here, we surveyed second-year medical students on their expectations about the possibility of participating in an innovation experience involving formal debate with flipped classroom.

During the 2017/2018 academic year, we proposed an activity consisting of flipped classroom and formal debate to second year medical students. The general aim of the innovation experience was to improve communication skills and critical thinking, as well as to develop educational strategies for autonomous learning and to encourage the active participation of students in the construction of knowledge. After the initial proposal, students were asked to fill in a questionnaire with eight questions regarding their expectations about the activity. Students were asked to rank each question from 0 to 3, being 0 the minimum and 3 the maximum score.

This study collects data of the survey to sixty-seven medical students from Complutense University of Madrid on their future participation in the afore-mentioned innovation activity. Generally, the students showed positive expectations for the activity. None of the questions was ranked 0 from any of the surveyed students and all questions received over 80% positive scores (2 and 3) with a mean of 90% positive scores. The highest expectation was shown for training student capacity of obtaining information from scientific articles (97% of positive answers; 61.2% maximum score). The lowest expectation was shown for improving their problem-solving ability (80.6% of positive answers; 44.8% maximum score).

The proposal of an activity combining flipped classroom with formal debate created positive expectations in medical students. Although our results confirmed that it was a feasible and useful alternative to the traditional classroom, our students were more interested in the possibility of increasing their capacity of analysis, improving their oral and written communication skills and training their capacity of obtaining information than in developing a critical attitude towards research or improving their problem-solving ability.

Keywords: Communication skills, Critical thinking, Formal debate, Flipped classroom, Health Sciences.

## 1 INTRODUCTION

The general aim of the innovation experience was to encourage the active participation of students in the construction of knowledge, as well as to develop didactic strategies for their autonomous learning and to design active processes of acquisition of skills and abilities for their professional performance.

With this idea, in recent years, the flipped classroom, a student-centered approach to learning that increases active learning for the student compared to the traditional classroom approach [1], has gained popularity as a feasible and useful alternative to the traditional classroom [2]. There is increasing evidence that the flipped classroom model has components that can be appealing to both

teachers and students and helps the students achieving some important goals as allowing them to become critical thinkers while stimulating the development of a deep understanding of the study material [4]. However, this approach requires more independent work from students who, in Medical School, are often more focused on final exam marks than in knowledge acquisition itself. On the other hand, instructional or formal debate is a methodology that incorporates the theory of learning along life together with the active participation of students [5]. Using formal debate in higher education has been associated with improving communication and empathy, critical-thinking ability, literature searching, and application of evidence, teamwork, and self-directed learning [6, 7, 8].

The aim of the present study was to survey second-year medical students on their expectations about the possibility of participating in an innovation experience involving formal debate with flipped classroom.

## 2 METHODOLOGY

During the 2017/2018 academic year, we proposed an activity consisting of flipped classroom and formal debate to second year medical students. The formal debate would involve two groups of 3-6 students each: one supporting a resolution (affirmative team) and one opposing the resolution (opposing team). The rest of the class would participate judging the quality of the evidence and arguments and the performance in the debate. Students were given the possibility to form groups as preferred and also to pick topics from a given list. However, it would be raffled whether they would represent the affirmative team or the opposing one.

Participating students would not be considered mere passive actors. Therefore, they could not use the materials provided by professors, but they would have and be encouraged to search, compose and prepare their own material, which would have to be shared with the rest of the participating student groups, and later discussed in the class. Being aware of the difficulty that this may imply, the discussed topics would be limited to those addressed in seminar lectures. Furthermore, students would have at all times the advice, guidance and tutoring of the participating professors [9].

The general aim of the innovation experience was to improve communication skills and critical thinking, as well as to develop educational strategies for autonomous learning and to encourage the active participation of students in the construction of knowledge. After the initial proposal, students were asked to fill in a questionnaire with eight questions regarding their expectations about the activity (Table 1).

*Table 1 Survey proposed to the students.*

| **Do you think that the proposed activity would…?**<br>**(Please rank each question from 0 to 3, being 0 the minimum and 3 the maximum score)** |
|---|
| Increase your capacity for analysis and synthesis |
| Improve your oral and written communication skills |
| Train your ability to obtain information |
| Improve your problem-solving ability |
| Improve your ability of work in interdisciplinary teams and improve the interpersonal relationships skills |
| Develop a critical attitude towards research and scientific publications |
| Learn autonomously |
| Train creativity and initiative applied to the knowledge of **H**ealth **S**ciences |

## 3 RESULTS

This study collects data of the survey to sixty-seven medical students from Complutense University of Madrid on their future participation in the afore-mentioned innovation activity. All 67 students were on the second year of their medical degree. All had similar course loads and schedules.

Table 2 shows a summary of the student opinion survey on the flipped + formal debate format proposal. Most students consistently showed positive expectations for the activity (Table 2).

*Table 2. Results of the survey proposed to the students.*

| | 0 | 1 | 2 | 3 | 0+1 | 2+3 |
|---|---|---|---|---|---|---|
| Increase your capacity for analysis and synthesis | 0% | 4.48% | 47.76% | 47.76% | 4.48% | 95.52% |
| Improve your oral and written communication skills | 0% | 4.48% | 31.34% | 64.18% | 4.48% | 95.52% |
| Train your ability to obtain information | 0% | 2.98% | 35.82% | 61.19% | 2.99% | 97.01% |
| Improve your problem-solving ability | 0% | 19.40% | 35.82% | 44.78% | 19.40% | 80.60% |
| Improve your ability of work in interdisciplinary teams and improve the interpersonal relationships skills | 0% | 10.45% | 37.31% | 52.24% | 10.45% | 89.55% |
| Develop a critical attitude towards research and scientific publications | 0% | 7.46% | 32.83% | 59.70% | 7.46% | 92.54% |
| Learn autonomously | 0% | 10.45% | 38.81% | 50.74% | 10.45% | 89.55% |
| Train creativity and initiative applied to the knowledge of health sciences | 0% | 14.93% | 37.31% | 47.76% | 14.92% | 85.07% |

None of the questions was ranked 0 from any of the surveyed students and all questions received over 80% of positive scores (2 and 3) with a mean of 90% of positive scores. The highest expectation was shown for training student capacity of obtaining information from scientific articles (97% of positive answers; 61.2% maximum score). The lowest expectation was shown for improving their problem-solving ability (80.6% of positive answers; 44.8% maximum score).

The most commonly reported expectation that students showed was that the pre-class preparation would allow them to come up with more thoughtful knowledge and would force them to stay up to date with the material, thus making studying for the exams easier.

Although none of the students ranked with the lowest possible value any of the questions, the more negative expectations included the feeling that the proposal would increase workload and that this effort would not be reflected in the number of credits.

## 4 CONCLUSIONS

The results of this study indicated that the proposal of an activity combining flipped classroom with formal debate created positive expectations in medical students. The results confirmed that it was a feasible and useful alternative to the traditional classroom. Regarding student opinions, they were more interested in the possibility of increasing their capacity of analysis, improving their oral and written communication skills and training their capacity of obtaining information than in developing a critical attitude towards research or improving their problem-solving ability. Interestingly, students were generally enthusiastic about this proposal and their overall perception was very favorable to it. However, it is intriguing that some students still retained unfavorable views while simultaneously reporting that this format would train them to improve some abilities that are not often addressed during their academic career. In conclusion, our initial proposal of a flipped classroom model in combination with a formal debate experience was considered largely positive.

## ACKNOWLEDGEMENTS

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# BRINGING SCIENCE AND SOCIETY CLOSER TOGETHER AND PROMOTING SCIENTIFIC VOCATIONS: AN EDUCATIONAL EXPERIENCE WITHIN THE MADRID SCIENCE AND INNOVATION WEEK

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## Abstract

Making the theoretical and practical work carried out in laboratories and research centers comprehensible to citizens produces culture, participation, innovation and wellbeing. In this way, the techniques, tools and language used for involving the general public in topics with no apparent relation with their everyday life have been gradually refined over time. Scientific dissemination is an important tool for expanding the frontiers of knowledge, as it fuels a virtuous circle, which allows researchers to reach society and citizens to reap the rewards of society's investment in research. In this regard, Madrid Science and Innovation Week is a major event designed to contribute to cultural growth globally. Its objective is to bring science and technology closer to citizens, especially young people, and to promote scientific vocations and creativity, eliminating gender barriers. This event is held annually and includes hundreds of events, which are open to the public and organized with the support and coordination of regional, provincial and municipal administrations. This year we organized an activity titled "Why do we age?" in which we first explained the theoretical basis of the aging process and then we took the participants to the lab, where they had to perform an experiment and analyze the results. The activity was open to the general public, but high school students were given priority. Our aim was, on one hand, to make our research visible and comprehensible to citizens, and on the other hand, to stimulate scientific vocations, in particular in science, technology, engineering, and mathematics (STEM) areas in which, in a close future, there will be lack of graduate professionals.

Approximately 80 people took part in our activity, being 90% of them high school students. Although some of them reported that the theoretical part resulted too difficult to understand, the vast majority of the participants showed great interest and engagement throughout the entire activity. In addition, all participants enjoyed the lab part and, having started with a skeptical attitude, they were surprised very positively to be able to carry out an experiment autonomously. High school students showed particular excitement and even some manifested their intention to study a degree related to the STEM areas in the future.

In conclusion, our experience was very positive for both professors, who felt involved in a different and rewarding activity, and participants, who displayed interest during the activity and gratitude at the end of it.

Keywords: Science popularization, High school students, Lifelong learning.

## 1 INTRODUCTION

Learning needs to be examined across the lifespan because previous notions of a divided lifetime education followed by work are no longer tenable [1]. Professional activity has become so knowledge-intensive and fluid in content that learning has become an integral and irremovable part of adult work activities. Learning is a new form of labor, and working is often (and needs to be) a collaborative effort among colleagues and peers. In the emerging knowledge society, an educated person will be someone who is willing to consider learning as a lifelong process. More and more knowledge, especially advanced knowledge, is acquired well past the age of formal schooling, and in many situations through educational processes that do not center on the traditional school [1].

Lifelong learning results from integration of formal, non-formal, and informal learning to create ability for continuous lifelong development of quality of life. Definitions highlight that the context within which learning takes place, occurs at all times in each place, through one's life. People need to upgrade their skills throughout their adult lives to cope with modern life, both in their work and in their private lives [2]. The basic premise of lifelong learning is that it is not feasible to equip learners at school, college,

or university with all the knowledge and skills they need to prosper throughout their lifetimes. Therefore, people will need continually to enhance their knowledge and skills, in order to address immediate problems and to participate in a process of continuous vocational and professional development. The new educational imperative is to empower people to manage their own learning in a variety of contexts throughout their lifetimes [3, 4].

Scientific dissemination is an important tool for expanding the frontiers of knowledge, as it fuels a virtuous circle, which allows researchers to reach society and citizens to reap the rewards of society's investment in research. There is a broad consensus on this issue, in both the academic and scientific communities as well as society at large. The growing awareness of the importance of research and the dissemination of its findings has been the driving force behind new studies and further research, both on the levels of communication and the rapport between science and society.

In 2001 the Education Ministers of Europe set the objective of boosting enrolment in scientific and technical fields of study to contribute to the Lisbon process of fostering a dynamic and innovative knowledge-based economy. Since then, the European Commission has set up the Maths, Science and Technology (MST) Cluster to facilitate peer learning and development in this area, and various studies/reports at European level have focused on how to improve some or various aspects of Science, Technology, Engineering and Mathematics (STEM) education in Europe [5]. The development of effective and attractive STEM curricula and teaching methods, and improved teacher education and professional development are at the heart of the drive to make STEM studies and careers a more popular option for young learners [5].

STEM includes some of the most versatile and important careers in the contemporary world. Most new developments that are making the world a better place to live in are from the contributions of STEM fields. As the world becomes more technologically developed, the economy, power and leadership of nations are becoming more heavily based on effective practice and the number of skilled workers in these fields. As a result, the success, security and leadership position of a nation depend not only on the use of technology, but also the number of native workers in STEM fields. The technology-driven economy and skilled workforce in STEM fields are the driving force for innovation of a nation [6].

On this regard, Madrid Science and Innovation Week is a major event designed to contribute to the scientific cultural growth globally [7]. Cultural growth has become a prerequisite for the exercise of people's rights as citizens, who are increasingly called on in their daily lives to make decisions that require a firm grasp of some scientific basics. The objective of this event is to bring science and technology closer to citizens, especially young people, and to promote scientific vocations and creativity, eliminating gender barriers. Also, it aims to make available to citizens the topics and issues that interest and concern them, discovering research centers as work spaces to improve their lives in the short and long term and the activities carried out in them [7].

Madrid Science and Innovation Week is held annually and includes hundreds of events, including a wide range of exhibitions, experiments and presentations. It hosts more than 300 institutions including universities as well as innovation companies and local establishments. All activities are open to the public and organized with the support and coordination of regional, provincial and municipal administrations.

In this context, we present here a learning activity organized for the 2018 Madrid Science and Innovation Week, and open to the general public, with the aim to contribute to Science popularization and lifelong learning as well as creating scientific vocations.

## 2 METHODOLOGY

Our research group has been studying the aging process during the last decades. Thus, we proposed an activity that would bring research on the ageing process closer to the general public. With this aim, we organized an activity titled "Why do we age?" in which we first explained the theoretical basis of the aging process and then we took the participants to the lab, where they had to perform an experiment and analyze the results.

The activity was open to the general public but high school students were given priority. Our aim was, on one hand, to make our research visible and comprehensible to citizens by explaining the theoretical basis of the aging process. On the other hand, our aim was to stimulate scientific vocations, in particular in scientific areas in which, in a close future, there will be lack of graduate professionals, by taking people to the laboratory and making them experiment firsthand the daily life of researchers.

## 3 RESULTS

Approximately 80 people took part in our activity, being 90% of them high school students.

The activity was proposed during three days, and the same protocol was proposed every day to allow people who could not attend one particular day to have more options of attendance. On the first day, approximately 20 people took part in the activity. None of the participants were high school students. They came from different backgrounds, including Economics, Law or Social Sciences. Some of them reported that the theoretical part resulted too difficult to understand, although they participated with great attention and with a very proactive attitude. Regarding the lab part, they showed great fear and they all stated firstly that they were firmly convinced to be completely unable to do it. However, against their own beliefs, they all were able to complete the experiments with good results and they were very positively surprised for it. A couple of people, who needed to leave the activity before the planned end, asked for help in completing the protocol and were interested in receiving the experiment results.

On the second and third days mainly high school students took part in the activity. Their attitude was completely different. They had a good theoretical preparation which allowed them to understand the first part in an easier way, and they showed great enthusiasm for the practical part. They participated during all the activity with great seriousness and concentration. All their experiments showed good results. Both students and their teachers expressed their gratitude to us for allowing the students to enter the lab and do a practical experience which is not easily and frequently done in high schools.

Their great interest and engagement throughout the entire activity also cheered up the researchers and pre-doctoral students of our research group who helped in the organization, implementation and execution of the activity. When asked, after the activity, about their impressions on the whole experience, they generally expressed that seeing such a positive and exciting attitude towards our daily work infused new energy and helped them to recover the excitement that sometimes the routine work tends to wane.

Finally, some of the high school students who showed particular excitement during the activity manifested their intention to study a degree related to the STEM areas in the future.

## 4 CONCLUSIONS

In conclusion, our experience was very positive for both professors, who felt involved in a different and rewarding activity, and participants, who displayed interest during the activity and gratitude at the end of it.

## ACKNOWLEDGEMENTS

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